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Case study of the winter 2013/2014 extreme wave events off the west coast of Ireland

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Ireland has a long history of storm waves reaching its shores. Due to its position in the Northeast Atlantic, Ireland is regularly on the path of very energetic extratropical weather systems, which can bring with them phenomenal sea-states and extreme wave conditions. The recent winter of 2013/2014 is a memorable one due to the large number of winter storms that affected Ireland, resulting in serious and widespread coastal damage. We examine one of these systems, which resulted in a record 23.4 m maximum individual wave height at the M4 wave buoy off the coast of Donegal, in a significant wave height of over 15 m. Nearshore wave buoy records, off Killard Point in Co. Clare, also measured phenomenal sea-states close to the shore in intermediate water depths. For this reason, developers of ocean energy devices need to take into account that although there is a huge ocean energy resource available of the west coast of Ireland, there is a percentage of extreme events which may cause damage to the devices. Since the buoy data in Irish nearshore waters is sparse, both in space and in time, a hindcast properly validated against available measurements will allow developers to choose adequate locations for device deployment, ensuring that device operation encounters as little down-time as possible. Using the third generation WAVEWATCH III wave model in an unstructured formulation, and driven by HARMONIE-AROME mesoscale model hourly winds with a 2.5 km horizontal resolution, we reproduce this storm and analyse its affect on the western coastline of Ireland. WAVEWATCH III was forced at its ocean boundaries by directional wave spectra obtained from the ECMWF ERA-Interim re-analysis dataset. The wave model has a high resolution grid (up to 225 m resolution in the nearshore) with around 20000 nodes, producing an abundance of important wave parameters outputted hourly, enabling a high quality, high-resolution analysis of the winter storms of 2013/2014.